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SUNSCREEN

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[There are no amendments to this patent.]

Abstract**Objective**

To provide a sunscreen excellent in UV shielding, transparency, durability, feel, heat insulation, heat retention, and the prevention of snow adhesion [to the skin].

Constitution

Sunscreen characterized by being obtained by compounding 100 parts by weight of the product with 0.5-15 parts by weight of water repellent-treated metal oxide microparticles with an

average primary particle diameter of 5-100 nm, 0.2-15 parts by weight of a polyoxyalkylene-modified organopolysiloxane, and 0.4-30 parts by weight of an elastomer and/or resin-based wax.

Claims

1. Sunscreen characterized by being obtained by compounding 100 parts by weight of the product with 0.5-15 parts by weight of water repellent-treated metal oxide microparticles with an average primary particle diameter of 5-100 nm, 0.2-15 parts by weight of polyoxyalkylene-modified organopolysiloxane, and 0.4-30 parts by weight of an elastomer and/or resin-based wax.

2. Sunscreen characterized by being obtained by compounding 100 parts by weight of the product with 0.5-15 parts by weight of water repellent-treated metal oxide microparticles with an average primary particle diameter of 5-100 nm, 0.2-15 parts by weight of a polyoxyalkylene-modified organopolysiloxane, 10-60 parts by weight of water, and 0.4-30 parts by weight of an elastomer and/or resin-based wax.

3. Sunscreen characterized by being obtained by compounding 100 parts by weight of the product with 0.5-15 parts by weight of water repellent-treated metal oxide microparticles with an average primary particle diameter of 5-100 nm, 0.2-15 parts by weight of a polyoxyalkylene-modified organopolysiloxane, 10-60 parts by weight of water, 0.4-30 parts by weight of an elastomer and/or resin-based wax, and 0.3-10 parts by weight of polyvinylpyrrolidone.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention concerns sunscreens formed by compounding sunscreens with elastomers and resin-based waxes, excellent in heat insulation and heat retention without sacrificing UV shielding, transparency, durability, and cost.

[0002]

More specifically, the present invention concerns sunscreens obtained by forced dispersion of elastomers and resin-based waxes in stable compositions of water repellent-treated metal oxide microparticles and polyoxyalkylene-modified organopolysiloxanes, effecting the formation of uniform water repellent coatings imparted with snow adhesion prevention, heat insulation, and heat retention, while UV shielding, transparency, and durability are retained.

[0003]

Prior art and problems to be solved by the invention

Conventionally, as the heat retention effect utilizing far-IR radiation of ceramic powders is described in Japanese Kokai Patent Application No. Sho 63[1988]-188611, it has been well known that using them in foundations in winter elevates

excellent heat insulation and heat retention. When including these powders in foundations, the heat insulation and retention of the powders are not clear, and their use in male-targeted cosmetics does not make much sense, because males tend not to use foundations.

[0004]

However, in winter sports such as skiing and mountain climbing, people are exposed to UV that is stronger than in the summer, and various sunscreens having high SPF values are sold in the market. In developing such sunscreens, efforts have been concentrated to maximize UV shielding without making skin look white after application.

[0005]

As a result of intense research concerning such problems, we have succeeded in imparting heat retention properties while UV shielding is maintained without the loss of transparency by combining the conventional sunscreen technology with elastomers and resin-based waxes that become transparent upon application. In addition, such elastomers and resin-based waxes prevent adhesion of snow to the face, reducing the chill from snow melting on the skin.

[0006]

Conventionally, as described in, e.g., Japanese Kokoku Patent No. Hei 4[1992]-17162 and Japanese Kokai Patent Application No. Hei 2[1990]-243612, elastomers have been used in lipsticks, creams, etc. for feel control and transparency, while there have not been any examples for imparting heat insulation properties to sunscreens.

[0007]

While rubbers have been known to have heat insulation properties, it has not been known whether rubbers in powder form would provide transparency on skin or effective heat insulation and heat retention.

[0008]

The objective of the present invention is to provide sunscreens having not only UV shielding effects, but also heat retention and excellent effects in low-temperature sports.

[0009]

Means to solve the problems

The present invention concerns a sunscreen characterized by being obtained by compounding 100 parts by weight of the product with 0.5-15 parts by weight of water repellent-treated metal oxide microparticles with an average primary particle diameter of

5-100 nm, 0.2-15 parts by weight of a polyoxyalkylene-modified organopolysiloxane, and 0.4-30 parts by weight of an elastomer and/or resin-based wax.

[0010]

Next, the present invention is explained in detail. The metal oxide microparticles used in the present invention should have an average primary particle diameter of 5-100 nm, and such metal oxide microparticles include, e.g., titanium oxide microparticles, zinc oxide microparticles, cerium oxide microparticles, etc., while titanium oxide microparticles and zinc oxide microparticles are preferred for UV shielding effects.

[0011]

The average primary particle diameter can be measured by scanning electron microscopy or transmission electron microscopy. There are no restrictions on the metal oxide crystal type, while the titanium oxide microparticles may be rutile, anatase, or amorphous, and titanium oxide microparticles synthesized in vapor phase are preferred, because of low aggregation tendency. The metal oxide microparticles may be spherical, acicular, rodlike, or irregular.

[0012]

The metal oxide microparticles used in the present invention may also contain aluminum, silicon, zirconium, iron, and cerium oxide in the form of composites or surface treatment.

[0013]

In the present invention, it is necessary that the metal oxide microparticles be surface-treated for water repellency as well as oil repellency. Such surface treatments include alkoxyalkylsilane treatment, perfluoroalkylalkoxysilane treatment, silicone treatment, metal soap treatment, organic titanate treatment, silane coupler treatment, organic aluminate treatment, lubricant treatment, fluorocompound treatment, N-acyl lysine treatment, plasma treatment, pentyl group addition treatment, etc. Surface treatment in vapor phase is preferred for avoiding the aggregation of particles in wet processes.

[0014]

In a preferred surface treatment process, an alkylalkoxysilane and metal oxide microparticles are heated in an atmosphere of nitrogen, inert gases or dry air, or tetramethylcyclotetrasiloxane is polymerized on the metal oxide microparticle surface.

[0015]

In the present invention, water repellency means that when powder is placed on a standing water surface, at least a portion of the powder remains on the water surface after 5 min.

[0016]

In the present invention, the amount of the metal oxide microparticles used to 100 parts by weight of the product is 0.5-15 parts by weight, preferably 1-6 parts by weight, more preferably 2-4 parts by weight. Below 0.5 part by weight, UV shielding is not sufficient, while above 15 parts by weight, transparency may be lost on skin.

[0017]

When it is necessary to elevate heat retention of the products, the elastomer content on the skin may have to be increased, but high metal oxide microparticle content would make the skin white. Thus, mainly for heat retention, the metal oxide microparticle content should be small, and the product should be applied heavily.

[0018]

The polyoxyalkylene-modified organopolysiloxanes used in the present invention are the compounds having polyoxyalkylene chains at a side and/or terminal chain of the silicone main chain. The side and/or terminal chain may also contain hydrogen, an alkyl group of 1-18 carbon atoms, a phenyl group, or a fluoroalkyl group of 1-10 carbon atoms. More specifically, examples include polyether-modified silicones, alkylpolyether-modified silicones, and perfluoroalkylpolyoxyalkylene-modified organopolysiloxanes. The polyoxyalkylene chains may be polyoxyethylene or polyoxypropylene. The perfluoroalkylpolyoxyalkylene-modified

organopolysiloxanes are described in Japanese Kokai Patent Application No. Hei 6[1994]-246144.

[0019]

The polyoxyalkylene-modified organopolysiloxanes used in the present invention should have an HLB value of 0.5-6 for excellent water resistance.

[0020]

The amount of the polyoxyalkylene-modified organopolysiloxanes used in the present invention should be 0.2-15 parts by weight, preferably 0.5-8 parts by weight to 100 parts by weight of the product. Below 0.2 part by weight, the metal oxide microparticle stability is not sufficient, while above 15 parts by weight, coatings would have a poor feel.

[0021]

The elastomers and resin-based waxes used in the present invention include, e.g., organopolysiloxane elastomers, polyethylene wax, polypropylene wax, Teflon wax, acrylic resins, methacrylic resins, urethane resins, styrene resins, and mixtures thereof. Among them, especially preferred are organopolysiloxane elastomers, polyethylene wax, polypropylene wax, Teflon wax, and mixtures thereof.

[0022]

The elastomers and resin-based waxes used in the present invention may be surface-treated by the usual manner with perfluoroalkyl phosphate salts and metal soaps.

[0023]

The elastomers and resin-based waxes used in the present invention are in an amount of 0.4-30 parts by weight, preferably 1-20 parts by weight to 100 parts by weight of the product. Below 0.4 part by weight, heat retention cannot be felt at low temperature, while above 30 parts by weight, flowability is poor.

[0024]

The elastomers and resin-based waxes used in the present invention should be micropulverized before or after compounding. Without such micropulverization, the elastomer may absorb solvents and swell, giving a poor feel, loss of transparency, etc. Micropulverization may be done by wet process, e.g., micros [transliteration], bead mill, dynomill, sand mill, ball mill, attrition mill, ang [transliteration] mill, paint conditioner, roller mill, etc. with high pulverizing power. The pulverized elastomers and resin-based waxes raise the product viscosity, enhancing the system stability.

[0025]

The elastomers of the present invention are resin compounds having elasticity. Evaluation involves placing a specimen in a tube of several cm in diameter and pressing from the top. The presence of any cushioning property makes the specimen an elastomer.

[0026]

The difference between the resin-based waxes used in the present invention and resin powder can be judged by softness. A metal sample mount of a scanning electron microscope is taped with a conductive double-sided tape, which is then coated with a specimen, and some specimens are rubbed by finger, and some are not. The specimens are observed under an electron microscope. Specimens showing significant deformation by rubbing are considered resin-based waxes, and those with no deformation are considered resin powders.

[0027]

The sunscreens of the present invention may be in two forms, one with volatile organic solvents and the other in water as a W/O-type emulsion. More specifically, nonaqueous systems with a water content less than 100 parts by weight to 10 parts by weight of the product, and aqueous systems containing 10-70 parts by weight, preferably 35-60 parts by weight to 100 parts by weight of the product. The volatile organic solvents include, e.g.,

lower alcohols such as ethanol, propyl alcohol, isopropyl alcohol, etc.; volatile silicones such as cyclosilicones, low-molecular-weight linear silicones, etc.; liquid isoparaffins, fluorohydrocarbons such as perfluorodecalin, etc., LPG, ethers, etc., while cyclosilicones are preferred. Comparison of aqueous and nonaqueous systems shows that the nonaqueous systems leaving no water to dry on the skin provide better heat retention feel.

[0028]

In the present invention, heat retention means low-temperature lowering in the applied area, compared with a nonapplied area. Such a difference can be felt by experimenting when it is snowing or raining or the temperature of the body surface is 0°C or lower.

[0029]

The sunscreens of the present invention may also contain, in addition to the above components, common cosmetics additives such as powders, colorants, resins, oils, UV absorbers, silicone oils, surfactants, perfumes, preservatives, antiseptics, physiologically active components, thickeners, solvents, etc.

[0030]

The powders may be, e.g., iron oxide microparticles, carbon black, cerium oxide microparticles, etc., and also organic-modified montmorillonite, bentonite, etc.

[0031]

The oils may be, e.g., higher alcohols such as cetyl alcohol, isostearyl alcohol, lauryl alcohol, hexadecyl alcohol, octyldecanol, etc.; fatty acids such as isostearic acid, undecylenic acid, oleic acid, etc.; polyols such as glycerin, sorbitol, ethylene glycol, propylene glycol, polyethylene glycol, etc.; esters such as myristyl myristate, hexyl laurate, decyl oleate, isopropyl myristate, hexyldecyldimethyloctanoate, glycerin monostearate, diethyl phthalate, ethylene glycol monostearate, octyl oxystearate, etc.; hydrocarbons such as liquid paraffin, petroleum, squalane, etc.; waxes such as lanolin, reduced lanolin, carnauba wax, etc.; oils such as mink oil, cacao oil, coconut oil, palm-kernel oil, camellia oil, sesame oil, castor oil, olive oil, etc.; ethylene- α -olefin cooligomers, etc.

[0032]

Other forms of oils include, e.g., silicon compounds such as dimethylpolysiloxane, methyl hydrogen polysiloxane, methylphenylpolysiloxane, biphenylpolysiloxane, alkyl-modified organopolysiloxanes, terminal group-modified organopolysiloxanes, fluorine-modified organopolysiloxanes, silicone gels, acrylic silicones, trimethylsiloxy silicic acids, silicone RTV rubber, etc.; fluorine compounds such as perfluoropolyethers, fluorinated pitches, fluorocarbons, fluoro alcohols, etc.

[0033]

The surfactants may be anionic, cationic, nonionic, or betaine.

[0034]

The organic UV absorbers are, e.g.,
2-ethylhexyl-p-methoxycinnamate (e.g., Parasol MCX, product of Dibodan Co.), 2-ethylhexyl-p-dimethylaminobenzoate,
2-hydroxy-4-methoxybenzophenone,
2-hydroxy-4-methoxybenzophenone-5-sulfonic acid,
2,2'-dihydroxy-4-methoxybenzophenone,
diethanolamine-p-methoxyhydrocinnamate, p-aminobenzoic acid (hereafter PABA), ethyldihydroxypropyl PABA, glyceryl PABA, octyldimethyl PABA, homomenthyl salicylate,
methyl-o-aminobenzoate,
2-ethylhexyl-2-cyano-3,3-diphenylacrylate, octylmethoxycinnamate, octyl salicylate, 2-phenylbenzimidazole-5-sulfonic acid, triethanolamine salicylate, 3-(4-methylbenzylidene) camphor, 2,4-dihydroxybenzophenone, 2,2',4,4'-tetrahydroxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone,
2-hydroxy-4-N-octoxybenzophenone, 4-isopropyldibenzoylmethane, 4-tert-butyl-4'-methoxydibenzoylmethane (e.g., Parasol 1789, product of Dibodan Co.),
2-ethylhexyl-4-(3,4-dimethoxyphenylmethylene)-2,5-dioxo-1-imidazolidinepropionate (Softshade DH, product of Ajinomoto Co.)

[0035]

The physiologically active components include, e.g., vitamins such as vitamin C, anti-inflammation agents, inflammation drugs, blood circulation promoters, hormones, antihistamines, etc.

[0036]

In the sunscreens of the present invention, the organic UV shielding agents may include those blocking the UV-A region and also those blocking the UV-B region, and for product system stabilization, polyvinylpyrroldione may be added. The polyvinylpyrrolidone includes vinylpyrrolidone-hexadecene copolymers, vinylpyrrolidone-styrene copolymers, vinylpyrrolidone-eicosene copolymers, etc., while the vinylpyrrolidone-hexadecene copolymer is most preferred. The amount of the polyvinylpyrrolidone polymers added to 100 parts by weight of the sunscreens should be 0.3-10 parts by weight, preferably 0.5-3 parts by weight. Below 0.3 part by weight, stabilization is not sufficient, while above 10 parts by weight, tackiness prevails.

[0037]

The sunscreens of the present invention may be used under cosmetics and they can be combined with foundations for more enhanced UV shielding and heat retention.

[0038]

Application examples

Next, the present invention is explained in detail with examples. The evaluation methods used in the present invention are given below.

[0039]

Various characteristics

A panel [consisted] of 16 males, ages 26-36. The sunscreens prepared in the application examples and comparative examples were compared under half-face comparison during skiing. Evaluation was made by interviewing the panel members for 6 items: ① tanning as a confirmation for UV shielding effects, ② whiteness upon application for transparency, ③ third-party observation of breaking for durability, ④ stickiness for feel, ⑤ chilling feel for heat insulation and heat retention, and ⑥ snow adhesion. For ⑥, some cases did not include the snow adhesion test ⑥, due to weather conditions, and are indicated with * for no snow test.

[0040]

For the application example being superior to the comparative example for each panel member, +1 point is given, while -1 point is given for the opposite, and a zero for no difference. Then, total points are divided by the number of panel

members, and results are given. Namely, the higher is the numerical value, the better the application example than the comparative example. A value near zero indicates very small difference between the application example and the comparative example. The (-) in Comparative Example 3 indicated no comparision of UV shielding, durability, and feel.

[0041]

Experimental conditions are given below.

Test date: January 15, February 4, 5, 20, 21, 1995

Test site: Shirouma village, Nagano prefecture, Norikurakoen, Inawashirocho of Fukushima prefecture.

Body surface temperature: -12°C to 6°C (using ski watch by Casio; body surface temperature measured on the middle of back)

Weather: snow (3 days), cloudy to clear (2 days)

[0042]

Application Example 1

Sunscreens were prepared according to Table I. The elastomer used was E-505C (organopolysiloxane elastomer) of Toray Dow Corning Silicone. The Teflon wax used was from MPI Co.

[0043]

Table I

① 配合成分	配合量 ② (重量部)
③ 成分A	
④ パラソルMCX (有機系紫外線吸収剤, UV-B対応)	10.0
⑤ パラソル1789 (有機系紫外線吸収剤, UV-A対応)	2.0
⑥ 中質流動イソパラフィン	1.0
⑦ スクワラン	1.0
⑧ 固形パラフィン	0.5
成分B⑨	
⑩ アルキルアルコキシシラン処理微粒子酸化チタン (平均一次粒子径30nm)	3.0
⑪ シリコーン処理微粒子酸化亜鉛 (平均一次粒子径50nm)	0.5
⑫ ポリエーテル変性シリコーン (信越化学工業製 KF-6017)	0.5
⑬ パーフルオロアルキル・ポリオキシエチレン 共変性シリコーン	4.0
⑭ オクタメチルシクロテトラシロキサン (現状シリコーン)	33.0
⑮ デカメチルシクロペンタシロキサン (現状シリコーン)	31.0
⑯ トリメチルシリケート	2.0
⑰ エラストマー	8.5
⑲ テフロンワックス (MP社製)	3.0

- Key: 1 Compounding components
 2 Compounded amount (parts by weight)
 3 Component A
 4 Parasol MCX (organic UV absorber to UV-B)
 5 Parasol 1789 (organic UV absorber to UV-A)
 6 Medium liquid paraffin
 7 Squalane

- 8 Solid paraffin
- 9 Component B
- 10 Alkylalkoxysilane-treated titanium oxide microparticles
(average primary particle diameter of 30 nm)
- 11 Silicone-treated zinc oxide microparticles (average
primary particle diameter of 50 nm)
- 12 Polyether-modified silicone (KF-6017, product of
Shin-Etsu Kagaku Kogyo Co.)
- 13 Perfluoroalkylpolyoxyethylene-modified silicone
- 14 Octamethylcyclotetrasiloxane (cyclic silicone)
- 15 Decamethylcyclopentasiloxane (cyclic silicone)
- 16 Trimethyl silicate
- 17 Elastomer
- 18 Teflon wax (product of MPI Co.)

[0044]

Component A was melted by heating, mixed with the component B with forced dispersion in a paint conditioner and filled into a container to obtain a product.

[0045]

Application Example 2

Sunscreens were prepared according to Table II. The elastomer used was E-505C (organopolysiloxane elastomer) of Toray Dow Corning Silicone Co.

[0046]

Table II

(1) 配合成分	(2) 配合量 (重量部)
(3) 成分A	
④ パラソルMCX (有機系紫外線吸収剤)	10.0
⑤ スクワラン	1.0
⑥ 固形パラフィン	0.5
(7) 成分B	
⑦ アルキルアルコキシラン処理微粒子酸化チタン (平均一次粒子径 30 nm)	3.0
⑨ ポリエーテル変性シリコーン (信越化学工業製 KF-6017)	0.5
⑩ パーフルオロアルキル・ポリオキシエチレン 共変性シリコーン	2.0
⑪ オクタメチルシクロテトラシロキサン	16.0
⑫ デカメチルシクロペンタシロキサン	16.0
⑬ トリメチルシリケート	2.0
⑭ エラストマー	4.0
⑮ テフロン・ポリエチレン複合ワックス (MPI社製)	3.0
(16) 成分C	
(17) 精製水	42.0

- Key:
- 1 Compounding components
 - 2 Compounded amount (parts by weight)
 - 3 Component A
 - 4 Parasol MCX (organic UV absorber)
 - 5 Squalane
 - 6 Solid paraffin
 - 7 Component B
 - 8 Alkylalkoxysilane-treated titanium oxide microparticles
(average primary particle diameter of 30 nm)

- 9 Polyether-modified silicone (KF-6017, product of Shin-Etsu Kagaku Kogyo Co.)
- 10 Perfluoroalkylpolyoxyethylene-modified silicone
- 11 Octamethylcyclotetrasiloxane
- 12 Decamethylcyclopentasiloxane
- 13 Trimethyl silicate
- 14 Elastomer
- 15 Teflon wax (product of MPI Co.)
- 16 Component C
- 17 Purified water

[0047]

Component A was melted by heating, mixed with component B with forced dispersion in a paint conditioner, then the component C was dispersed in paint conditioner and filled into a container to obtain a product.

[0048]

Application Example 3

Sunscreens were prepared according to Table III. The elastomer used was E-505C (organopolysiloxane elastomer) of Toray Dow Corning Silicone Co.

[0049]

Table III

配合成分 ①	配合量 (重量部) ②
③ 成分A	
④ パラソルMCX (有機系紫外線吸収剤)	12.0
⑤ パラソル1789 (有機系紫外線吸収剤)	3.0
⑥ ポリビニルピロリドン・ヘキサデセン共重合体	1.0
⑦ 中質流動イソパラフィン	0.5
⑧ 成分B	
⑨ アルキルアルコキシシラン処理微粒子酸化チタン (平均一次粒子径30nm)	3.0
⑩ ポリエーテル変性シリコーン (信越化学工業製 KF-6017)	0.5
⑪ パーフルオロアルキル・ポリオキシエチレン 共変性シリコーン	7.0
⑫ オクタメチルシクロテトラシロキサン	8.0
⑬ デカメチルシクロペンタシロキサン	8.0
⑭ トリメチルシリケート	2.0
⑮ エラストマー	0.5
⑯ テブロン・ポリエチレン複合ワックス (M P I 社製)	5.0
⑰ 成分C	
⑱ 精製水	49.5

- Key:
- 1 Compounding components
 - 2 Compounded amount (parts by weight)
 - 3 Component A
 - 4 Parasol MCX (organic UV absorber)
 - 5 Parasol 1789 (organic UV absorber)
 - 6 Polyvinylpyrrolidone-hexadecene copolymer
 - 7 Medium liquid paraffin

- 8 Component B
- 9 Alkylalkoxysilane-treated titanium oxide microparticles
(average primary particle diameter of 30 nm)
- 10 Polyether-modified silicone (KF-6017, product of
Shin-Etsu Kagaku Kogyo Co.)
- 11 Perfluoroalkylpolyoxyethylene-modified silicone
- 12 Octamethylcyclotetrasiloxane
- 13 Decamethylcyclopentasiloxane
- 14 Trimethyl silicate
- 15 Elastomer
- 16 Teflon wax (product of MPI Co.)
- 17 Component C
- 18 Purified water

[0050]

Component A was melted by heating, mixed with component B with forced dispersion in a paint conditioner, then the component C was added and dispersed into a wet super-pulverization apparatus, and filled into a container to obtain a product.

[0051]

Comparative Example 1

Application Example 2 was repeated using nylon powder in place of the elastomer and Teflon-polyethylene composite wax to obtain a sunscreen.

[0052]

Comparative Example 2

A commercially available high-SPF sunscreen (SPF value 35) was used for comparison.

[0053]

Comparative Example 3

Comparison was made without using a sunscreen.

[0054]

Comparative Example 4

Application Example 2 was repeated using a homomixer of weak pulverizing power instead of the paint conditioner with high pulverizing power to obtain a sunscreen.

[0055]

Results are given in Table IV. In Table IV, the experimental weather and temperature conditions were not the same, but different, thus comparing numerical values collected from different sets of experiments may not be very significant.

[0056]

Table IV

① 実施例	② 比較例	③ 評 価 項 目					
		紫外線 ④ 防護	透明性 ⑤	持続性 ⑥	感 触 ⑦	断熱性・ 保温性 ⑧	雪の 付着 ⑨
①	実施例 1	比較例 1	0.50	0.50	1.00	0.25	0.75
	実施例 1	比較例 2	0.00	0.50	0.50	0.50	0.75
	実施例 2	比較例 1	0.00	0.75	0.75	0.25	0.75
	実施例 2	比較例 2	0.00	0.00	0.20	0.40	1.00
	実施例 2	比較例 3	(-)	-1.00	(-)	(-)	1.00
	実施例 2	比較例 4	0.00	1.00	0.00	1.00	0.00
	実施例 3	比較例 2	0.00	0.50	0.25	0.25	0.75

- Key:
- 1 Application Example
 - 2 Comparative Example
 - 3 Evaluation items
 - 4 UV shielding
 - 5 Transparency
 - 6 Durability
 - 7 Feel
 - 8 Heat insulation and retention
 - 9 Snow adhesion

[0057]

As shown in Table IV, the application examples have UV shielding and transparency that are not very different from conventional products, but durability and feel are superior, as well as heat insulation and heat retention, thus snow adhesion on the face is effectively prevented. Actual experimentation showed

that such heat retention effect was pronounced at a body surface temperature below 0°C or during snowing, otherwise not much difference [occurred] in some cases.

[0058]

Application Example 2 and Comparative Example 4 showed that with weak pulverizing power, elastomer is not dispersed well in the system, thus transparency and feel were poor, and the elastomer is readily stretched by rubbing, leading to reduced UV shielding, durability, and heat retention.

[0059]

The products of the present invention also have strong water repellency.

[0060]

Effects of the invention

As shown above, the present invention provides sunscreens of excellent UV shielding, transparency, durability, feel, heat insulation, heat retention, and snow adhesion prevention.